

Application No. 10/827,097
Amendment and Response Dated January __, 2006
Reply to Office Action dated October 18, 2005

REMARKS

I. Status of Present Application

Prior to the entry of this amendment, Claims 1, 9, 12, 14, 15, and 19-49 were pending in this application. By this amendment, Applicant has canceled Claims 19-26, 29, 30, 33, and 41-44; amended Claims 1, 31, 35, 36, 45, 46, 47, and 48; and added new Claims 50-54. Applicant respectfully requests examination and reconsideration of Claims 1, 9, 12, 14, 15, 27, 28, 31, 32, 34-40, and 45-54.

In the October 18, 2005 action, the Office objected to Claims 36, 37, and 46, but indicated that the claims would be allowable if rewritten in independent form. In response, the Applicant has rewritten Claim 36 in independent form. Claim 37 depends from Claim 36. Claim 46 has also been rewritten in independent form. Therefore, Claims 36, 37, and 46 are allowable, and Applicant requests notification of the same.

Claims 1, 9, 12, 14, 15, 26-28, 31-35, 38-40, and 45 stand rejected as being unpatentable over U.S. Patent No. 6,312,123, issued to Codos et al. (the "Codos reference"), in view of other references. The Applicant addresses these rejections below.

II. Section 103(a) Rejection of Claims 9, 12, 14, 27, 28, 31, 34, 35, 39, and 40

According to the Office,

1. Claims 9, 12, 14, 27, 28, 31, 34, 35, 39, 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Codos et al. (USPN 6,312,123) in view of Ort (USPN 4,340,893) and Jackson (New cold-curing high performance UV system).

The Office notes that the Codos reference teaches a substrate support, and at least one ink jet print head on the carriage. The Office goes on to state that the Codos reference teaches at least one UV curing head on the carriage "sufficiently close to the ink jet print head and the UV curing head being configured to emit sufficient UV energy to cure the ink jetted onto the substrate, at least partially cure, a substrate formed of such material, so that the surface of the

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material being printed upon does not move from the plane of printing." The Office cites column 4, lines 53-58 and column 7, lines 14-15 in support of these assertions. Reproduced below are portions from the Codos reference including the text in column 4, line 53 through column 5, line 3 as well as text from column 7, lines 12-18. Nowhere in the cited text is there any mention of UV curing in such a manner so that "the surface of the material being printed upon does not move from the plane for printing." Further, there is no text that could be construed as supporting such an assertion.

Column 4, line 53 through column 5, line 3 reads as follows.

The UV curing station 24 includes a UV light curing head 23 that may move with the print head 30 or, as is illustrated, move independently of the print head 30. The UV light curing head 23 is configured to sharply focus a narrow longitudinally extending beam of UV light onto the printed surface of the fabric. The head 23 is provided with a transverse drive 19 which is controlled to transversely scan the printed surface of the fabric to move the light beam across the fabric. Preferably, the head 23 is intelligently controlled by the controller 35 to selectively operate and quickly move across areas having no printing and to scan only the printed images with UV light at a rate sufficiently slow to UV cure the ink, thereby avoiding wasting time and UV energy scanning unprinted areas. If the head 23 is included in the printing station 25 and is coupled to move with the print head 30, UV curing light can be used in synchronism with the dispensing of the ink immediately following the dispensing of the ink.

Column 7, lines 12-18, reads as follows.

2. The method of claim 1 wherein the curing step includes the steps of:

exposing the UV curable ink jetted onto the fabric to UV light to at least partially cure the ink on the fabric; and

heating the fabric having the at least partially cured UV light cured ink thereon to reduce its content of uncured UV curable ink.

The cited portions of the Codos reference disclose that a UV lamp can be placed on the same carriage as the printhead, that the emission of UV light can be synchronized with the jetting of ink, and that a two-step curing process using heat is carried out. None of this teaches or suggests the asserted emission of UV light so that the surface of the material being printed upon

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does not move from the plane of printing. And, as will be discussed below, the Codos reference actually teaches away from the proposed combination.

In column 1, line 24 through column 2, line 51, the Codos reference describes various problems associated with printing on fabrics. Nowhere are rigid and deformable substrates such as foam board mentioned. Among other problems discussed with respect to UV printing on fabrics, the noted section indicates, in relevant part, that

[t]o cure UV ink, it must be possible to precisely focus a UV curing light onto the ink. UV ink, when jetted onto fabric, particularly onto highly textured fabric, is distributed at various depths over the texture of the fabric surface. Furthermore, the ink tends to soak into or wick into the fabric. As a result, the ink is present at various depths on the fabric, so that some of the ink at depths above or below the focal plane of the UV curing light evade the light needed to cause a total cure of the ink. In order to cure, UV ink must be exposed to UV light at an energy level above a curing threshold. However, increasing the intensity of the curing light beyond certain levels in order to enhance [the] cure of the ink can have destructive effects on the fabric.

UV curing of jetted ink on fabric has a limited cure depth that is determined by the depth of field of the focused curing UV light. Therefore, the UV light proceeds to cure only about 90%, or 97%, and can be even up to about 99% of the ink when deposited on fabric. However, if more than an order of magnitude of approximately 100 parts per million (PPM) (0.01%) of the total volume of the jetted ink remains uncured, persons sensitive to the uncured monomers can suffer reactions. This is particularly unacceptable for fabrics such as mattress covers, as well as for clothing and many other fabrics.

Further, ink jet printing can be carried out with different ink color dots applied in a side-by-side pattern or in a dot-on-dot (or drop-on-drop) pattern. The dot-on-dot method is capable of producing a higher color density, but the higher density dot-on-dot pattern is even more difficult to cure when the cure is by UV light.

In addition, UV ink can be applied quickly to reduce wicking and UV ink can be developed to allow minimized wicking. Some wicking, however, helps to remove artifacts. Further, inks developed to eliminate wicking leave a stiff paintlike layer on the surface of the fabric, giving the fabric a stiff feel or "bad hand". Therefore, to reduce the UV curing problem by eliminating wicking is not desirable.

For the reasons stated above, UV curable inks have not been successfully used to print onto fabric. Heat curable inks can be cured on fabric. As a result, the ink jet printing of solvent based inks and

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heat curable or air dryable ink has been the primary process used to print on fabric. Accordingly, the advantages of UV curable ink jet printing have not been available for printing onto fabric.

Interestingly, even though the Codos reference recognizes that heat may be a problem when printing on fabric because (as discussed elsewhere) using a UV lamp with an extremely high output may cause "burning or even combustion of the fabric," heat is part of the process described in the Codos reference. Furthermore, other than briefly mentioning the burning or combustion that might occur in extreme situations, **the Codos reference is silent as to any deformation or movement from the plane of printing that might occur due to heat.** Instead, the Codos reference addresses a problem where if too much UV curing occurs too quickly, wicking of the ink into the fabric is eliminated. One solution proposed by Codos is that UV curing of at least about 90% be promoted and then heat be applied in a drying station. In other words, less than 100% UV curing is used in combination with heat or drying to cure the fabric. Without the drying, an acceptable cure is not accomplished. The Codos reference states, in relevant part, that

[t]he UV curing station 24, in the illustrated embodiment, is located immediately downstream of the printing station 25 so that the fabric, immediately following printing, is subjected to a UV light cure. In theory, one photon of UV light is required to cure one free radical of ink monomer so as to set the ink. In practice, one joule of UV light energy per square centimeter of printed surface area is supplied by the UV curing head 23. This is achieved by sweeping a UV beam across the printed area of the fabric at a power of 300 watts per linear inch of beam width. This is sufficient to produce a UV cure of at least 90%. Increasing the UV light power up to 600 watts per linear inch can be done to achieve a 97% or better cure. Alternatively, if fabric thickness and opacity are not too high, curing light can be projected from both sides of the fabric to enhance the curing of the UV ink. Using power much higher can result in the the [sic] burning or even combustion of the fabric, so UV power has an upper practical limit.

The heat curing or drying station 26 is fixed to the frame 11, preferably immediately downstream of the UV light curing station. With 97% UV cure, the ink will be sufficiently color-fast so as to permit the drying station to be off-line, or downstream of the quilting station 27. When on-line, the drying station should extend sufficiently along the length of fabric to adequately cure the printed ink at the rate that the fabric is printed. Heat cure at the oven or drying station 26 maintains the ink on the fabric at about 300° F. for up to three minutes. Heating of from 30 seconds to 3 minutes is the anticipated acceptable range. Heating by forced hot air is preferred,

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although other heat sources, such as infrared heaters, can be used as long as they adequately penetrate the fabric to the depth of the ink.

(Col. 5, lines 4-34). Therefore, the Codos reference teaches the inclusion of heat in curing fabrics and the caveat that heat so high as to cause burning or combustion should be avoided does not change this fact, it is a merely a warning that it is possible to go too far with UV curing and to generate too much heat.

The Office notes that the Codos reference does not teach the use of cold UV. However, the Office asserts that U.S. Patent No. 4,340,893, issued to Ort ("the Ort reference") teaches two dryers on the carriage and that it would be obvious to have a curing head moveable with the print head as taught by the Ort reference to "provide for bi-directional printing." The Office continues its argument by noting that an article entitled "New Cold-Cure High-Performance UV Systems," authored by P. Jackson (the "Jackson reference") teaches using cold UV to cure ink and that it would be obvious to one of ordinary skill in the art to use cold UV to improve product quality. With due respect, the argument fails to support a proper rejection under Section 103.

As noted, Codos teaches a system that uses UV and a two-stage process where once a UV cure of, in one example, between about 90% to about 97% has occurred, a drying process that maintains the ink on the fabric at about 300° F is carried out. Why would one of ordinary skill in art be motivated to modify the teachings of the Codos reference to use cold UV when heat is clearly noted as desirable and maintained? The answer is --there is no reason to modify the teachings of the Codos reference. As noted, Codos teaches that too full of a UV cure can eliminate wicking, but some wicking is desirable. Thus, a drying process is used to achieve a full cure of the ink, but avoid the problems of too much UV curing. Therefore, Codos teaches away from Applicant's claimed subject matter. This is true even in light of the comment about avoiding burning and possible combustion of fabric. As noted, this is merely an indication about an extreme upper limit. More importantly, Codos already provides a solution to this problem by noting that UV lamps at or below about 600 watts per linear inch produce suitable cures. In other words, cold UV lamps are not required to solve any problems with heat that might exist with the process taught by the Codos reference. So, at best, the Office is asserting that someone of ordinary skill in the art would be motivated to fix a problem that does not exist. Of course, this is not the case.

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The Office's references to the substrate deforming in the direction of the printhead as it relates to the prior art are erroneous. Simply put, not one of the cited references discusses substrate deformation into the printhead. This language only appears in Applicant's application. Therefore, as this problem is discussed by the Office, it appears that the Office has engaged in an impermissible hindsight analysis. For example, how is one of ordinary skill in the art motivated to "improve product quality" to avoid deformation of a foam board or similar substrate based on the combination of the Codos and Jackson references, when it appears that Codos has solved the problem of printing on fabrics and is silent on the issue of deformation of foam board? Only with the benefit of the Applicant's teachings is there any such motivation. Accordingly, the proposed combination of the Codos, Ort, and Jackson references fails to render the claimed subject matter obvious and the claims rejected on the basis of the same should be allowed.

In the Parent Application, the Office made a similar argument with respect to the patentability of the claims in that application. In particular, the Office rejected certain claims in the Parent Application under 35 U.S.C. § 103(a) as being unpatentable over the Codos reference in view of the Ort reference and U.S. Patent No. 4,563,589, issued to Scheffer (the "Scheffer reference").

In both the Parent Application and the present application, the Office relies on the Codos and Ort references in the same manner, for the same teachings. In the Parent Application, the Scheffer reference was relied upon to teach that cold UV curing lamps *per se* are not new. In the rejection made in the present application, the Office relies on the Jackson reference as teaching the use of cold UV to cure ink. The Office asserts that "[s]ince Jackson teaches using cold UV to cure the ink . . . [i]t would have been obvious to one having ordinary skill in the art at the time the invention was made [to] modify [it] to use cold UV as taught by Jackson. The motivation of doing so is to improve product quality."

In short, the Office has done nothing more than rehash a rejection which Applicant successfully overcame in an appeal that it filed in the Parent Application. Moreover, independent of the arguments made by Applicant in the Parent Application, the prior rejection in the Parent Application fails for the same reasons that the present rejection fails. As explained, the Codos reference teaches away from the use of cold UV.

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Furthermore, the Jackson reference is devoid of any discussion of spot curing and foam board. Jackson focuses on an alleged high-performance cold UV system, which presumably provides better performance in applications known at the time, which are noted as "printing and coating on **thin** PVC or polythene sheets, printed circuit board assembly and silicon wafer production." Consistent with what the Applicant has noted in the specification, these applications appear to cover situations where permanent damage or burning occurs. However, there is no mention of temporary deformation that occurs during spot curing on relatively thick substrates such as foam board. Thus, there is nothing in Jackson that provides more motivation to use cold UV than the Scheffer reference previously relied on.

For all the above reasons, the Office has failed to provide sufficient motivation for combining the teachings of the references. Therefore, the rejection of Claims 9, 12, 14, 27, 28, 31, 34, 35, 39, and 40 based on the Codos, Ort, and Jackson references should be withdrawn.

III. Section 103(a) Rejection of Claim 45

Claim 45 stands rejected as being unpatentable over the Codos reference in view of an article entitled "Taming UV Temperature" authored by Anon (the "Anon reference"). As noted above, the Codos reference teaches away from using cold UV. Therefore, there is no motivation to make the proposed combination and the rejection of Claim 45 should be withdrawn.

IV. Section 103(a) Rejection of Claim 47

Claim 47 stands rejected as being unpatentable over the Codos reference in view of the Anon reference taken in combination with the Ort and Jackson references. Claim 47 is allowable for the same reasons Claim 45 is allowable.

V. Section 103(a) Rejection of Claim 15

Claim 15 stands rejected as being unpatentable over the Codos reference in view of the Ort and Jackson references and U.S. Patent No. 5,864,352, issued to Aoki et al. (the "Aoki reference"). As noted above, the Codos reference teaches away from using cold UV. Therefore, there is no motivation to make the proposed combination and the rejection of Claim 15 should be withdrawn.

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VI. Section 103(a) Rejection of Claim 32

Claim 32 stands rejected as being unpatentable over the Codos reference in view of the Ort and Jackson references and U.S. Patent No. 5,447,758, issued to Pelletier (the "Pelletier reference"). As noted above, the Codos reference teaches away from using cold UV. Therefore, there is no motivation to make the proposed combination and the rejection of Claim 32 should be withdrawn.

VII. Section 103(a) Rejection of Claim 48

Claim 48 stands rejected as being unpatentable over the Codos reference in view of the Anon reference and U.S. Patent No. 5,896,154, issued to Mitani et al. (the "Mitani reference"). As noted above, the Codos reference teaches away from using cold UV. Therefore, there is no motivation to make the proposed combination and the rejection of Claim 32 should be withdrawn.

VIII. Section 103(a) Rejection of Claims 9, 14, 27, 28, 31, 34, 35, 39, and 40

Claims 9, 14, 27, 28, 31, 34, 35, 39, and 40 stand rejected as being unpatentable over the Codos reference in view of the Ort, Jackson, and Mitani references. As noted above, the Codos reference teaches away from using cold UV. Therefore, there is no motivation to make the proposed combination and the rejection of Claims 9, 14, 27, 28, 31, 34, 35, 39, and 40 should be withdrawn.

IX. New Claims 50-54

New Claims 50-54 include limitations similar to those in other claims and are, therefore, allowable for at least the reasons noted above with respect to the other pending claims. It is also noted that Claims 31, 45, and 50-54 all include limitations to a vacuum. None of the cited references teaches or suggests controlling the emission of energy from a UV lamp while a vacuum is applied to a deformable substrate. Therefore, these claims are allowable for this additional reason.

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CONCLUSION

The Codos reference teaches away from the proposed combination. Accordingly, entry of this Amendment, allowance of Claims 1, 9, 12, 14, 15, 27, 28, 31, 32, 34-40, and 45-54, and issuance of a Notice of Allowance are respectfully requested. The undersigned is available for telephone consultation at anytime during normal business hours.

Respectfully submitted,

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